PROJECT DOCUMENT COVER SHEET

FILM HANDLING PROCEDURES

FOR

APOLLO 17 LUNAR SOUNDER

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FILM HANDLING PROCEDURES FOR APOLLO 17 LUNAR SOUNDER

INTRODUCTION

PURPOSE:

This document specifies all PTD film handling procedures for the Apollo 17 Lunar Sounder including purchase of flight film, establishment of processing standards, transportation of flight films, flight film certification, application of pre- and post-sensitometry, film loading and downloading, film processing, titling, and duplication.

REFERENCES:

REPORT MSC-04947 - Film Handling Procedures for Manned Space Flights

REPORT MSC-05826 - Procedures for Processing Scientific Instrumentation Bay (SIM Bay) Films

Report TN-72-4 - Determination of Film Processing Specifications for the Apollo 17 S-209 Lunar Sounder Experiment.

Report TN-72-11 - Kodak Film Type SO-394-4-1 Mottling and Hypersensitization Test.

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LIST OF ABBREVIATIONS

ASPO	Apollo Systems Program Office
E	Exposure
EAFB	Ellington Air Force Base, Texas
KSC	Kennedy Space Center, Florida
MRD	Mission Requirements Document
MSC	Manned Spacecraft Center, Texas
MTF	Modulation Transfer Function
NASA	National Aeronautics and Space Administration
PI	Principal Investigator
PR	Purchase Request
PTD	Photographic Technology Division
R&QA	Reliability and Quality Assurance
SIM Bay	Scientific Instrumentation Module Bay
T_a	Coherent Amplitude Transmission
TBD	To Be Determined
TPS	Test Preparation Sheet

SECTION I

1.0 Film Procurement

The Apollo Program Office notifies the Photographic Technology Division of the requirement for film to support the Apollo 17 Lunar Sounder. The PTD in conjunction with ASPO and the experiment Principal Investigators determine film type and quantities required. Section II of this document describes testing procedures used to determine film type and final certification standards.

1.1. Predelivery Requirements of the Manufacturer of Flight Film

1.1.1. Film will be packaged at 50% ± 20% relative humidity

1.1.2. Estar thin base film (2.5 mil base) - Recommended film winding tension for Estar thin base film is 20 to 35 inch-ounces for 70mm rolls. All 70mm films will be wound on type S cores.

1.1.3. Film will be packed to assure relative humidity retention. The 70mm films will be packaged in opaque paper and sealed in cans. The cans will be taped.

1.1.4. The manufacturer will assure that each order be of the same emulsion coat, and that each roll be labeled as to cut number.

1.1.5. The film manufacturer shall supply a certificate of compliance for the type of film that will contain the following information.

a. Date of manufacture

b. Predetermined date of expiration

c. Film size, width, and length

d. Type of perforation, if any

e. Emulsion thickness number

f. Base thickness

1.1.6. A Photographic Technology Division film courier shall accept the film shipment from the manufacturer. It is desirable to have film shipped from the manufacturer to MSC in an air-conditioned airplane that is supplied by NASA. In the event a NASA supplied airplane cannot be used, available aircraft will be used. The manufacturer will transport the film to the aircraft in an air-conditioned vehicle. Film shall not be exposed to temperatures above 85°F. for more than 4 hours during shipment. Within these constraints, humidity does not become a factor during shipping.

2.0 Receipt of Flight Film at MSC from manufacturer

2.1. The film courier shall notify the MSC Transportation Officer when the film shipment arrives at EAFB. The Transportation Officer has the film transported to the shipping and receiving warehouse (Bldg. 422) of MSC in an air-conditioned vehicle. At the warehouse, the MSC Receiving Officer and film courier inspect the film and perform standard acceptance tests in accordance with the prerequisites stated on the purchase request.

All film quantities are verified in accordance with the manufacturer's packing list and the Receipt and Inspection report is signed by the PTD representative.

Reliability and Quality Assurance inspectors verify the Certificate of Compliance.

Prior to transporting film to PTD by the transportation section, R&QA inspector prepares parts tags for each type of flight film. At this time, PTD is provided with the complete package of film support documents, which consists of a TPS, Order for Supplies and Services, Packing List, Receipt and Inspection Report, Certificate of Compliance, and Parts Tags. The film is then transported to PTD and placed in a storage vault (Room 226A, Bldg 8) until used.

2.2 Vertification Test

After the film is placed in the vault, the Photo Science Office of the PTD shall conduct a verification test. The test shall assure that the film is as the manufacturer

and the MSC purchase order specified and is within tolerance. The criterion for the verification test is the manufacturer's specification. The sensitometric plot made by the PTD shall be within the data-point parameter specified by the manufacturer. Film from each lot will be selected at random and tested to determine:

2.2.1. Length - when large spools of film are received, the manufacturer's spooling data are accepted as correct verification

2.2.2. Thickness

2.2.3. Width

2.2.4. Integrity (scratches, emulsion and/or base imperfections)

2.2.5. Sensitivity

2.2.6. Color balance for color film

SECTION II

1.0. Selection of Film Type and Determination of Processing Parameters

1.1. The Photo Science Office of the PTD works with the PI Team through the optical recorder Project Manager to determine optimum film and processing parameters. This determination is based on the following image quality criteria:

a. T_a versus E

b. Noise

c. MTF

d. Film Speed

Film size and thickness are determined by the design of the recorder and a consideration for the amount of film required to fulfill the objectives of the mission. In addition, extensive temperature fogging and film hypersensitization tests are performed to provide the PI Team with required premission data to plan for contingency situations. Detailed information concerning the techniques used to determine the optimum film and processing parameters and results of the testing accomplished for this purpose can be found in Technicolor Technical Note (TN 72-4), Determination of Film Processing Specifications for the Apollo 17 S-209 Lunar Sounder Experiment, and Technicolor Technical Note (TN 72-11), Kodak Film Type SO-394-4-1 Mottling and Hypersensitization Test.

1.2. Two months prior to launch, the PTD supplies to ASPO the final process control curves for the chosen film type for inclusion in the Mission Requirements Document. The MRD is an MSC-controlled document and subsequent changes of film types or processing require action and approval by the Configuration Control Board.

SECTION III

1.0 Film Certification Procedures

1.1. The sensitometric characteristics of each film type and emulsion are established by exposure on the I-B sensitometer and are controlled by processing as determined for the respective films. The condition for sensitometric exposure of each film type is specified as to:

a. Color temperature

b. Filtration, as prescribed by the film application

c. Exposure needed to place the resulting density exposure relationship in a desired position on the D-log E curve. For the Lunar Sounder, these conditions are 2850°K, P-11 filter pack, and 1/10 second exposure time.

1.2. After the processing machine has been certified, five sensitometric strips are processed. The densitometric values of these processed exposure wedges are averaged and the result is plotted to represent the certification data for subsequent sensitometric control for that particular film type.

1.3. Visually inspect one roll of each film type and size in white light for dirt, scratches, coating imperfections, etc.

1.4. After the inspection is completed, the inspected roll will be visibly marked and retained intact until after processing of the mission film.

SECTION IV

1.0 Film Loading, Downloading, and Application of Pre- and Postsensitometry

This section describes the procedure to be used for loading and downloading the spool and cassette, and applying pre- and postsensitometry to the flight film for the Apollo 17 Lunar Sounder.

2.0 Equipment and Facility Requirements

2.1. Preflight Equipment

Item No.	Equipment	Quantity
1	1000-foot rolls of Eastman Kodak Film Type TBD	2
2	Film Spools - Goodyear Aerospace Corp., Part # 3084715-010-001	2
3	Film Loader - Cinema Arts/Crafts Model # TR708N, SN 101	1
4	Scissors	1
5	Hole Punch	1
6	Hexagonal Wrenches	1 set
7	70mm x 250' film spool	1
8	70mm Rewinds	1
9	Film can for 70mm x 1000' spool	1
10	Black Paper Bag	1
11	White Cotton Gloves	2 pair
12	Black Pressure Sensitive Tape	1 roll
13	Film Can for 70mm x 250' spool	1

2.2. Preflight Facility Required

Sensitometer Darkroom - Building 8, Room 248B

2.3 Postflight Equipment

Item No.	Equipment	Quantity
1	Take-up Cassette - Goodyear Aerospace Corp., Part No. 3084714-002-201	1
2	Film Loader - Cinema Arts/ Crafts, Model # TR708N, SN 101	1
3	Scissors	1
4	Hexagonal Wrenches	1 set
5	70mm x 1000' Film Spool	1
6	70mm Rewinds	1 set
7	Film Can for 70mm x 1000' Spool	1
8	Black Paper Bag	1
9	White Cotton Gloves	2 pair
10	Black Pressure Sensitive Tape	1 roll
11	Can containing Houston Control	

2.4 Postflight Facility Required

Sensitometer Darkroom - Building 8, Room 248B

3.0 Preflight Procedures

3.1. Remove two 1000-foot rolls of bulk film from cold storage, and allow to remain in sealed container at room temperature (70 to 80°F.) for at least 6 hours prior to loading.

3.2 Preparation of Houston Control

3.2.1. Remove 10 feet of film from the bulk film rolls.

3.2.2. Make two sensitometric exposures on one end of the 10-foot section of film using the I-B Sensitometer with the lamp set at 2850°K, 1/10 second shutter speed, and the P-11 filter pack. Punch one hole at each end of the exposed area.

3.2.3. Place the exposed 10-foot section of film into a film can and seal with black tape. Label "Houston Control for Apollo 17 Lunar Sounder".

3.3 Film Spooling

3.3.1. Determine that film torque adjustment of film winding machine is set at 20 ± 2 inch-ounces. When using the PTD Cinema Arts Model TR708N Film Loader, set torque adjustment so that meter reads .06.

3.3.2. Place the Goodyear spool on the take-up spindle of the film winding machine.

3.3.3. All lights are extinguished and after five minutes a final check is made for possible light leaks. In total darkness, remove the film from all containers and wrapping. NOTE: Operations 3.3.3 through 3.5.11 inclusive must be performed in total darkness. Film must be handled with clean, lint-free, cloth gloves only.

3.3.4. Place the film on the supply spindle such that the film will be removed from the upper right side of the supply roll.

3.3.5 Using scissors, taper the film end so that it can be inserted into the slot of the Goodyear spool.

3.3.6 Thread film under the large stainless steel roller and over the Goodyear take-up spool, inserting the end of the film into the slot in the spool. Tape the film to the spool securely using Flight Qualified Tape.

3.3.7. Operate the film winding machine at a slow to moderate speed. Observe the supply spool area for evidence of static discharge. If static discharge is observed, discard that roll of film and begin loading with a new roll of film. Monitor quantity of film on Goodyear film spool

with gloved hand. Stop machine when film level is 1/8 to 1/4 inch from spool rim. Do not allow hands to rub any longer than momentarily on either spool. Prolonged contact could cause static buildup.

3.3.8. Cut film approximately midway between the winding machine spools and wind remaining film onto the Goodyear spool.

3.3.9 Remove Goodyear spool with the film from winding machine using gloved hand to prevent film unwinding.

3.3.10. Using a hole punch, punch one hole near the center of the film approximately ten (10) feet from the beginning of the film strip.

3.4. Sensitometry

3.4.1. Measuring from the punched hole, place two sensitometric exposures between 7.5 and 10 feet into the roll. Use the I-B sensitometer set at 2850°K with the P-11 filter pack and an exposure time of 1/10 second.

3.4.2. Rewind the loose film onto the spool by hand and secure with pressure-sensitive tape.

3.4.3 Repeat steps 3.2.1 through 3.4.2 for the backup roll. Place each roll in a black paper bag, and then in a film can. Seal with black pressure sensitive tape.

4.0 Postflight Procedures

4.1 Cassette Inspection and Unloading

4.1.1 The cassette will be visually inspected and a voice record will be made as to the condition of the cassette.

4.1.2. After the initial examination, the room will be totally darkened. No safelights will be on at any time during the removal of the film from the cassette. As the cassette is opened all comments will be recorded as to the following:

a. Estimated length of exposed footage.

b. Physical condition of film, such as torn, jammed, normal

4.1.3. Using a 5/32 inch hexagonal wrench, turn the two cover retaining screws counterclockwise. Move handle away from cover hinge while depressing handle locking pin.

4.1.4. Open the cassette cover.

4.1.5. Using a 5/32 inch hexagonal wrench, rotate the screw located in the reset of the left side of the handle when the handle is pulled toward you. Rotate the screw in a counterclockwise direction approximately four (4) turns.

4.1.6. Using a 3/16 inch hexagonal wrench, rotate the screw in the cylindrical plug on the left outside wall of the cassette clockwise. Continue until the male threaded fitting on the opposite end of the cylindrical plug (inside the cassette) disengages the female threaded fitting on the spool.

4.1.7. Rotate the film spool within the cassette by pulling the top of the spool toward the operator in order to release the threaded fittings. When the end of the film strip is freed from the cassette, secure to spool with pressure sensitive tape. Continue rotating the spool until the female fitting on the cassette disengages from the male threaded fitting.

4.1.8 Remove the film spool from the cassette.

4.1.9 The film is oriented <u>emulsion out</u> on the film spool. Place the Goodyear spool with the flight film on the supply spindle of the film loading machine.

4.1.10. Orient the spool so that when facing the machine the film is coming off the top left-hand part of the spool.

4.1.11. Thread film <u>under</u> the large stainless steel roller and <u>over</u> the take-up spool.

4.1.12. Tape the end of the film to the take-up spool.

4.1.13. Operate the film winding machine at a slow to moderate speed. Observe the supply spool area for evidence of static discharge. If static discharge is observed, slow winding machine, and continue at a slower speed.

4.2 Application of Sensitometry

4.2.1. After completion of winding operation, place spool with the flight film on a set of rewinds located on the I-B sensitometer.

4.2.2. Wind the film onto the opposite side of the set of rewinds until you reach the hole that had been punched approximately 10 feet from the end.

4.2.3. Proceed 5 feet from that point, and place two sensitometric exposures using the I-B sensitometer with the lamp set at 2850°K, 1/10 second shutter speed, and the P-11 filter pack.

4.2.4. Rewind film back onto one spool and secure with black pressure sensitive tape. Place spool with flight film into black paper bag.

4.2.5. Place bagged spool into film can and seal with black pressure sensitive tape.

4.2.6. Return take-up cassette to bonded storage.

4.2.7. Store flight film in cold vault (maintain at 55°F., 50% RH) until ready for processing.

4.3 Preparation of Houston Control

4.3.1. Obtain can with preexposures labeled "Houston Control" for Apollo 17 Lunar Sounder".

4.3.2. Make two sensitometric exposures on the end of the ten foot section of film opposite the end that has the holes punched. Use the I-B sensitometer with the lamp set at 2850°K, 1/10 second shutter speed, and the P-11 filter pack.

4.3.3 Return film to can , seal with black pressure sensitive tape, and deliver to the Motion Picture Laboratory to be processed with the original film.

SECTION V

1.0 Transportation of Flight Film from MSC to KSC

The film is placed in a thermal-insulated shipping case, whose interior is conditioned to the temperature of the PTD storage vault. The case will be sealed by the Quality Assurance Monitor, and a quality bond seal placed on the case will serve as verification of the integrity of the case and its content.

The first film courier delivers the case containing prime mission film to KSC. The second courier delivers the case containing the back-up film. Films prepared for flight and placed in the film shipping case will be transported to KSC by courier. Film shall not be exposed to temperatures above 85°F. for more than 4 hours during shipment. Within these constraints, humidity does not become a factor. Film is always carried in the passenger compartment when transported in a commercial aircraft. Upon arrival at KSC, the couriers shall proceed to the Manned Spacecraft Operations Building on Merritt Island. The film shall be placed in the bonded and controlled environmental storage area of the Manned Spacecraft Operations Building.

The bonded area, all darkrooms, and other film handling areas are controlled by KSC. However, MSC has the responsibility for maintaining the integrity of these areas. In order to reduce film degradation, it is desirable that flight film be loaded into the flight vehicle as near to the launch date as engineering will allow.

SECTION VI

1.0 Recovery and Transportation of Flight Film from Splashdown Area to MSC

1.1 The following parameters shall be observed for contingencies, as well as for the prime recovery areas of the spacecraft.

1.1.1. The Lunar Sounder film magazine shall be removed from the spacecraft as soon as the spacecraft is aboard the recovery ship. The Photographic Team Leader shall have the prescribed film shipping case at the spacecraft during the removal of the magazine.

1.1.2. As the photographic equipment is removed, it shall be inspected and packed in the PTD film handling case. Any visual damage shall be noted on the Apollo Spacecraft Hardware Utilization Request (MSC Form No. 710). After it has been determined that all equipment is packed, the case shall be sealed by the designated Quality Assurance representative aboard the recovery ship. The Photographic Team Leader or his designees will keep the case in their possession until the arrival of the film at PTD, Houston, Texas. He shall, also, record the environmental temperatures and time the timperatures were taken from the approximate time the film was removed from the spacecraft until the film arrives at PTD in Houston.

1.1.3. Upon return to Houston, Texas, the film courier shall be met by the MSC Quality Assurance representative, who shall take the courier to the receiving area in Building 420 or other designated area at MSC. Receiving personnel shall perform an inspection of the case (noting that the case is intact and that the bond seal has not been violated before removing a copy of the attached packing list). From Building 420, the case shall be transported to PTD, Bldg 8, Room 240B, by the courier and a Quality Assurance representative.

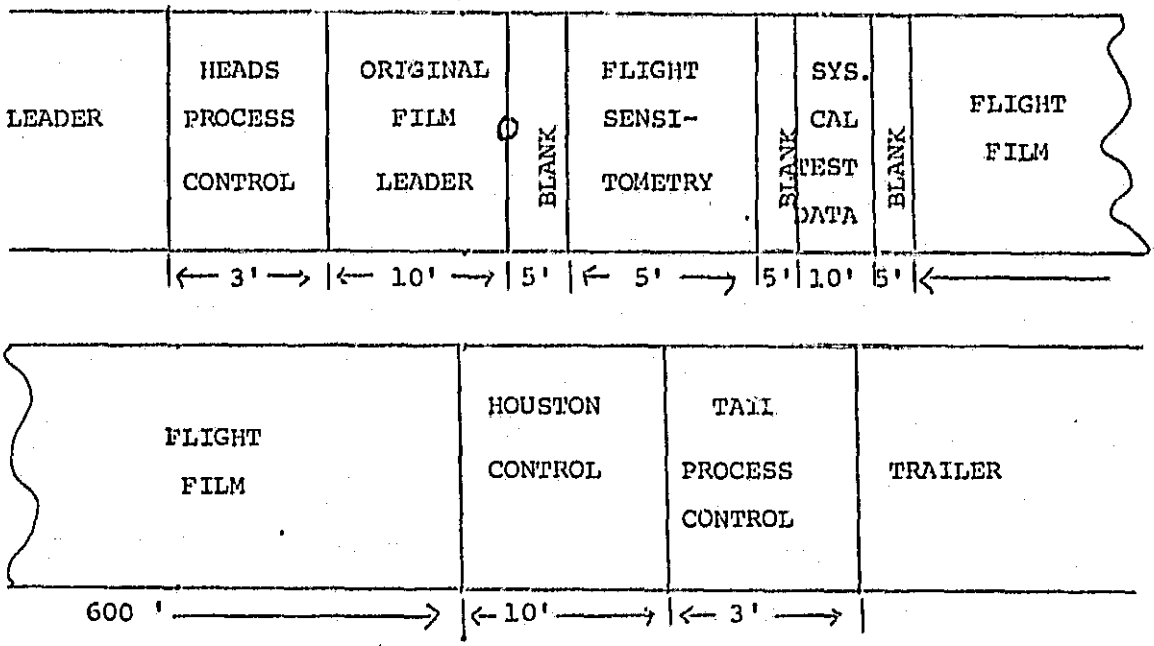
1.1.4 In room 240B the flight magazine shall be visually inspected according to a TPS, and the results recorded on an inspection form. At this time the R&QA representative approves the TPS and releases the magazine to PTD. The magazine is taken to room 292 where the film will be removed for the application of postsensitometry and processing.

SECTION VII

1.0 Procedures for Processing Original Lunar Sounder Film

2.0 Preprocessing Preparation

2.1. Film makeup will be performed in accordance with the the following format:



° 1/4 inch marker hole

2.2. Processor Certification

2.2.1. The machine and chemistry are brought into control by the processing of test strips of the same emulsion batch, and sensitometric exposure as used for initial certification. Final certification is based on the results of processing five sensitometric strips and plotting the average densities. The curve obtained must match the original certification curve within ± 0.05 density units, and ± 0.05 units of gamma.

3.0 Downloading of the Lunar Sounder magazine will be accomplished in Room 292.

3.1 Inspection, splicing, and processing of the film will be accomplished in room 187.

4.0 Equipment

3.1. Description and Nomenclature

The Hi-Speed 16mm, 35mm, and 70mm motion picture processor was constructed to NASA MSC Specification No. S-13551 by the Hi-Speed Equipment, Incorporated, Waltham, Massachusetts. The machine is designed for processing 16mm, 35mm, and 70mm films using color or black-and-white chemistry. It is an electrically powered, chain-driven, roller bearing machine using a sprocket film drive for 16mm film and friction drive for 35mm and 70mm film and has automated temperature control, impingement drying, and gravity flow rater replenishment systems.

Individual pumps for each developer serve for turbulation and filtration. Pen gauge recorders monitor the temperature of the developer tanks to $\pm$ 0.5°F. The machine employs a pump over system, with holding tanks for storage of developers.

5.0 Maintenance and Preparatory Steps

5.1. All primary and backup processing equipment shall be disassembled and cleaned as per standard maintenance procedures. These procedures are standard for the photographic industry and consist of disassembly of the roller assemblies and cleaning the dry box. Individual rollers are cleaned, and the bearings are inspected for wear and replaced if worn. The machines are aligned so that film passes from rack-to-rack in the correct manner.

5.2 To allow sufficient time for all mechanical and chemical verification tests, reassembly of automated equipment will be completed 1 week prior to projected receipt of flight film.

5.3. When acid dichromate or developer systems cleaners are used, the machine will be filled and flushed throughout all systems with a solution of trisodium phosphate followed by a thorough water wash.

5.4 Install new filter cores in the recirculation system of each solution plus the wash waterlines.

5.5. Confirm proper capability of the replenisher flow rater tubes and clean, if necessary.

5.6. All other systems; i.e., heat exchangers, temperature recording devices, speed controls, etc., will be checked by manual timing and temperature equipment for verification.

5.7. New motion picture machine leader will be used after inspection for defects.

5.8. Inspected machine leader will be installed in the emergency supply flanges located above the processor.

5.9. The machine leader for use with the flight film will be prespliced with control sensitometry at the tail end. The roll of leader will be a minimum of 800 feet long.

5.10. Prior to receipt of flight film, comprehensive and conclusive tests for scratches and abrasions, plus sensitometric-chemical verification, will be made.

5.11. Check solution levels in the machine tanks and, if low, notify the chemical mixing personnel to restore correct level with controlled starter solutions.

5.12. Check that adequate amounts of certified replenishers are available. Replenisher chemicals are piped from the second floor of building 8 through the ceiling of the first floor down to the Hi-Speed processor. Quality Control certifies each supply of replenisher chemicals.

5.13. Wipe down entire machine for dust, clean dry box, and install new air filters.

5.14. Check the operation of both emergency and regular nitrogen systems.

5.15.. Check alarm and warning signal systems.

6.0 Personnel Duties

6.1. The prime processing personnel will consist of two technicians to work the dark side and one technician on the light side of the machine. Only assigned technicians will

be allowed in the processing rooms. This is to prevent inadvertent malfunctions and mishaps from occurring when there are too many unneeded hands.

6.2. Two backup technicians will be available to relieve, if necessary, any personnel of the prime processing crew.

6.3. The processing technicians will assist the maintenance personnel with any aspects that directly pertain to the processing machine. However, processing technicians will not interfere in any way with the machine's electrical, hydraulic, et cetera, subsystems.

6.4. The motion picture processing supervisor and his assistant will inspect all work performed on the processor by the maintenance personnel.

6.5. After verification that the processor and the allied equipment are operational, the maintenance personnel will remain in the laboratory on a standby basis.

6.6. The chemical mixing technicians will be responsible for an adequate and on time supply of required solutions.

6.7. The quality control section will be responsible for all sensitometric chemical verifications. The section will advise the processing technicians about machine speed, temperature, and chemical conditions concerning the film to be processed.

7.0. Operating Procedures

7.1. All color chemicals are pumped to holding tanks or drained.

7.2. All tanks, racks, and plumbing system are filled and flushed with water a minimum of three times. All filters are changed.

7.3. The main drive chain is rethreaded to allow for skip tank processing.

7.4. Machine leader is rethreaded to the designated processing procedure.

7.5. Turn on auxiliary power derived from a separate electric generator. Auxiliary power from a portable generator is used during film processing. Film processing requires a constant source of power and will not be subjected to a possible house-current power failure. House-current power is used as the backup source of power in the event of an auxiliary power failure.

7.6. Check emergency nitrogen delivery system to squeegees to assure that it is operational.

7.7. Turn on water supply and check applicable rates. Applicable rates are adequate overflows into the flush-way sump.

7.8. Turn on exhaust system.

7.9. Turn on recirculator pump and check for proper operation. Proper operation of the recirculator pump is indicated when the pressure gauge reads 6 psi.

7.10. Start drying box blowers.

7.11. Start the machine drive and adjust the processor to proper speed as per instructions of the quality control department. Quality control determines speed from the graphic plots of sensitometric control strips.

7.12. With a stopwatch, verify the machine speed by checking the traversal time through the first developer.

7.13. When operating the machine with only leader, set the flow rater for replenishment at the prescribed leader rates.

7.14. While leader is going through the machine, check all squeegees for proper alignment and cleanliness.

7.15. Check the film leader for twists and rethread, if necessary.

7.16. Prior to extinguishing the lights on the loading end of the machine, check darkroom for all necessary equipment; i.e., sufficient machine leader, stapler and staples, and tape in the splicing machines.

7.17. Darken loading room and proceed to run scratch tests and sensitometric strips for evaluation by the quality control department.

7.18. Subsequent to downloading and priority assignment, the mission film will be turned over to the senior processing technician for makeup operations.

NOTE: Downloading is the removal of film from the camera magazine and winding the film onto the processing machine spools.

7.19. During makeup operations, the film will be inspected for damage or sticking. Any damaged conditions will dictate that the film be set aside for special handling when more extensive examinations will take place. All conversation during the operations will be monitored by a tape recorder.

7.20. Only one roll of 16mm, 35mm, or 70mm will be processed at a time. No additional film will be put on the machine until prior footage has completed the processing cycle and has been evaluated.

7.21. The film for processing will be joined to an 800-foot roll of prechecked machine leader by the overlapping method and secured by at least two stainless steel staples.

7.22. Transfer the entire roll of film onto the takeup side of the downloading assembly and splice another 2 feet of leader to the tail end of the film.

7.23. Mount the film and leader package on the machine loading spindle and lock in place.

7.24. Orally confirm via the intercom with the supervisor for final assurance of operation.

7.25. Attach the mission film leader to that leader on the processor by an overlapping staple splice.

7.26.. Release the lock on the loading accumulator and inform the outside technicians that the film is entering the processing cycle.

7.27. The prime technician on the dark end of the processor will check the loading accumulator for undue slack in the leader.

7.28. The prime dark side technician will maintain a close auditory and manual vigil until the film completely clears the dark end of the processor.

7.29. From the time the machine drive has been engaged, the technician on the light side of the processor will maintain a constant surveillance of the leader and film until it completely clears the machine.

7.30. After the film has completed its entrance into the light area of the processor, the darkroom side will be illuminated to check the machine. At this time, one of the dark area technicians will leave the darkroom to assist the light area technicians.

7.31. The flight film will be taken up on a core with the sensitometry, and the sensitometry will be removed after completion of processing.

7.32. After processing, the mission film will be turned over to the Precision Laboratory for duplication, and the sensitometry will be evaluated by the quality control department.

7.33. All procedures from 7.13 through 7.32 will be repeated for each additional roll of film to be processed.

8.0 Chemical Mixing and Analysis

8.1. The developer is mixed, using bulk chemicals, and thoroughly tested for pH, specific gravity, Hydroquinone, Elon, Sodium Bromide. When certified for use, machine tank is filled. Since there is a low footage volume of original to be processed, no replenisher is required. The volume of the developer tank is 220 gallons. During the running of these films, the developer is replenished with straight tank solution.

8.2. An antacid short-stop bath is put into the first wash tank. One cubetainer of Starfix is put into the first hardener tank, and 1 cubetainer of Starfix is put into the first acid rinse tank. Both are filled with water.

9.0. Analytical Standards

D-19

pH	10.10 ± 0.05
SpGr	1.126 ± .003
NaBr	4.30 ± .20
ELON	2.00 ± .20
H.Q.	8.00 ± .20

10.0 Preventive Measures and Emergency Procedures

10.1 Preventive Safeguards

10.1.1 Insure proper cleaning and maintenance of machinery with special emphasis on checking each individual roller bearing.

10.1.2. Auxiliary electrical power to be used during original film processing.

10.1.3. Emergency nitrogen for squeegees will be retested.

10.1.4. Rapid access and replacement fuses for machine.

10.1.5. New inspected machine leader will be used.

10.1.6. Double check all splices.

10.1.7. All splices will be made by the overlapping film method and secured with two stainless steel staples.

10.1.8. Dark side technician will physically check the film on the elevator at startup of the machine.

10.1.9. Light side technicians will maintain constant surveillance of the complete system.

10.1.10. Technicians will keep a constant surveillance of the machine. (Operators are so thoroughly familiar with the machine that they usually recognize malfunctions through sound indications.)

10.1.11. Emergency leader will be readily accessible from flanges located directly above the processing machine.

10.2. Emergency Procedures

Although close attention to preventive measures should preclude any problems, the following procedures will be followed in case of emergency. The flight film has a 2.5-mil Estar base; therefore, there is only a remote chance of breaking. It must be pointed out emphatically that due to an extremely short time element in which to

implement the following procedures and the environmental conditions to which the film is subjected in the processing chemistry, loss and damage will be the rule rather than the exception in the "worst case" situations that will be cited.

10.3 General Remedial Procedures

10.3.1. Stop processing machine immediately.

10.3.2. Analyze the problem and the extent of damage.

10.3.3. Inform assistant technician to render any needed assistance.

10.3.4. Follow specific procedures.

10.4. Specific Emergency Procedures

The following are"worst case" situations. Other malfunctions not mentioned here are believed to be insignificant to the point that remedial measures can be made to assure that no damage would be done to the film.

10.4.1. It must be pointed out that the following are procedures for salvage. Due to an extremely short time element, it is believed that if a head end break did occur in the first developer, the possibility of saving any imagery is very remote.

a. Head End Break

1. Cut film just prior to entering developer solution.

2. Rewind dry film back onto feed flange; remove and place in light-tight can and tape can.

3. Locate head of film and manually transport through short stop and fix into first wash light side. Resplice onto machine leader and process to completion.

4. Continue processing only after reliability assurance has been established.

B. Tail End Break

1. Continue manual or powered processing and process to completion.

2. Continue processing only after reliability assurance has been established.

C. Break or Sticking in Dry Box

1. Untangling and resplicing operations at this stage will be done slowly to minimize damaging the film, which is susceptible to abrasions at this time.

2. Turn on transport and recheck threading and traversal of film.

D. Electrical Power Failure

As the processor is operated by an emergency generator while processing flight film, it is only necessary to throw one switch to be immediately restored to "house current".

E. Drive Motor Failure/Drive Chain Breakage with Film in First Developer

1. Cut film just prior to entering developer solution.

2. Rewind dry film back onto feed flange; remove and place in light-tight can and tape can.

3. Locate head of film and manually transport through short stop and fix and into wash. Place film in container of water and feed into Houston Processor into final wash.

F. Machine Incapacitated for Long Period with Film Past the Developer

1. If repairs are estimated to be longer than one and one-half hours, unthread film and feed by hand into a large container of water. To complete processing, splice and feed the film into the Houston processing machine.

2. If repairs require less than one and one-half hours, the film is left threaded in the processing machine; then processed to completion.

3. Continue processing only after reliability assurance has been established.

SECTION VIII

1.0 Titling Procedures

1.1. Standard Apollo 17 Head and Tail Identification Forms will be applied to the mission film, and filled in as follows:

Magazine -	Apollo 17 Lunar Sounder Experiment S-209
Date -	Date of processing
Part -	1 of 1
Frames -	Insert film length
Film Type -	TBD
Camera System -	Lunar Sounder Optical Recorder

SECTION IX

1.0 Duplication Procedures

1.1. Read and plot densities of one of the sensitometric exposures applied to the original film.

1.2. Set up Versamat Processor for 1.0 gamma processing of Kodak Film Type 2422.

1.3. Expose step tablet read in 1.1 above in a Niagara Printer, using 70mm unsprocketed 2422 film at various exposure levels.

1.4. Process film from 1.3 above at a 1.0 gamma.

1.5. Plot resultant D-log E curves.

1.6. From these tests determine exposure and processing conditions so that the duplicate step tablet matches the original step tablet as closely as possible.

1.7. Expose and process duplicates as determined in 1.6 above.